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Air Force experiments return home on Discovery

by Larine Barr, AFRL Public Affairs

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — After existing nearly four years on the International Space Station, more than 800 Air Force experiments returned home with the space shuttle Discovery, which launched from Cape Canaveral, Fla., Aug. 1.

A space shuttle Discovery astronaut installs a special carrier on the International Space Station that houses Air Force Research Laboratory experiments. AFRL is studying a variety of materials and how they react to the space environment. (NASA photo)

The Materials on the International Space Station Experiment, or MISSE, was installed by the Discovery crew in August 2001 for what was to be a one-year science experiment to learn how different materials react when exposed to the rigors of space, according to Michael Stropki, a scientist with the Air Force Research Laboratory's Materials and Manufacturing Directorate at Wright-Patterson Air Force Base, where the experiments originated.

When the space shuttle Columbia exploded upon re-entry Feb. 1, 2003, the experiments would wait for the historic return-to-flight to be retrieved by the Discovery launch.

"While the experiments were originally planned to spend only one year in space, having existed four years there may have eroded away the entire material in a few of the specimens," explained Mr. Stropki, who was the initial program manager on the project in 2001.

"In those cases it will not be possible to know just how soon it took to reach failure," he said. "While at the same time, for other more successful candidates, the additional time in space will likely show that those materials have a greater durability and are able to survive the space environment for the longer periods needed for these materials."

The goal of the MISSE program – a $3 million cooperative effort between AFRL, the Department of Defense Space Test Program, Boeing Phantom Works, and NASA's Langley Research Center, Marshall Space Flight Center and Johnson Space Center – is to discover how materials are affected by exposure in an effort to develop more durable, reliable and affordable materials and technologies for future space vehicles.

"This information is crucial to providing the needed space materials for the 21st century," said Pat Valentino, AFRL's current program manager. "New, affordable materials are the enablers for advanced reusable launch systems and advanced spacecraft systems, including optics, sensors, electronics, power, coatings, structural materials and protection."

While at home on the orbiting space laboratory, the experiments have been housed in four passive experiment carriers, similar to suitcases, which NASA astronauts installed in strategic locations on the outside of the International Space Station. Some of the specimens include optical materials and coatings, light-weight radiation shielding materials, thermal control coat-

continued on page 2

continued from page 1

ings (flight paint), Kevlar and carbon foams, multi-layer insulation materials, solar cell technology, and specialty materials such as shape memory foil and x-ray resistant coatings.

At the direction of AFRL scientists, NASA integrators placed most of the specimens in aluminum trays that hold roughly 46 samples. Other specimens were installed directly onto the trays, while a few specimens were bolted underneath the base plates to ensure they were exposed only to solar radiation.

In addition to Air Force experiments, the MISSE payload carries 11 hand-picked experiments from six Dayton, Ohio-area students in grades 1-10. "Their assignment was to identify a problem associated with long duration flight, propose a solution, and design a passive experiment to find a solution," Mr. Stropki said. Included are experiments to learn how contamination migrates in a micro-gravity environment, how materials degrade, radiation shielding tests, and the effect of space on viral protein and nonpathogenic bacteria.

According to Ms. Valentino, all the specimens have faced such grueling perils as ultraviolet ray bombardment by highly corrosive atomic oxygen and exposure to intense solar radiation during maximum solar activity.

Astronauts will uninstall the MISSE containers from the exterior of the space station and return to Earth about three weeks after launch. From there, the materials will travel to NASA Langley Research Center in Virginia, where scientists will de-integrate and disassemble the containers, then ship them back to AFRL scientists to be analyzed and later reported at a MISSE symposium in 2006.

"We are incredibly exited that MISSE is finally returning home," Ms. Valentino said. "We look forward to analyzing the flight samples and continuing this program for future experiments." **@**